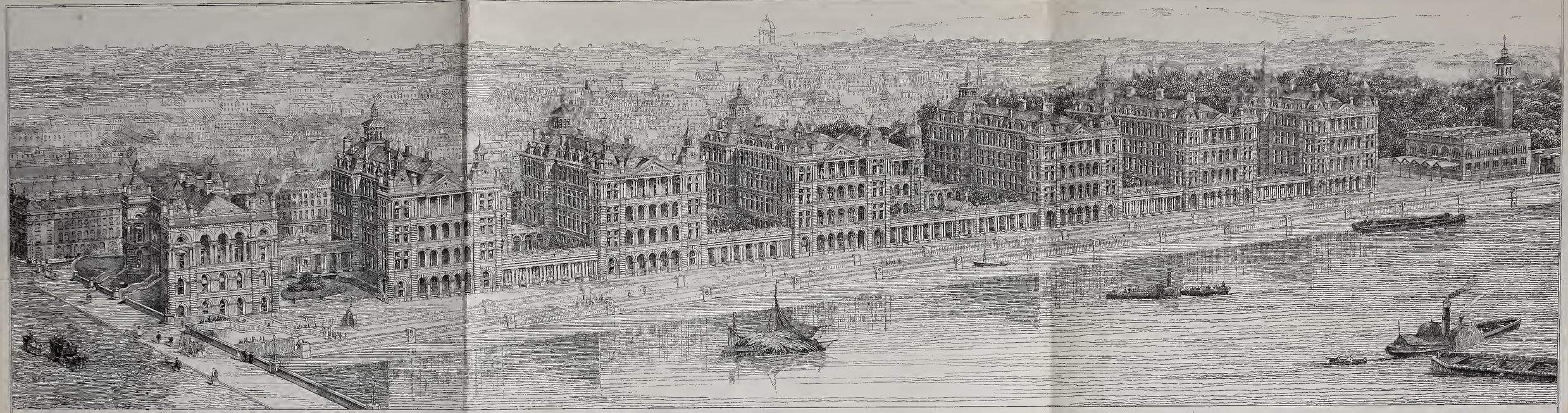

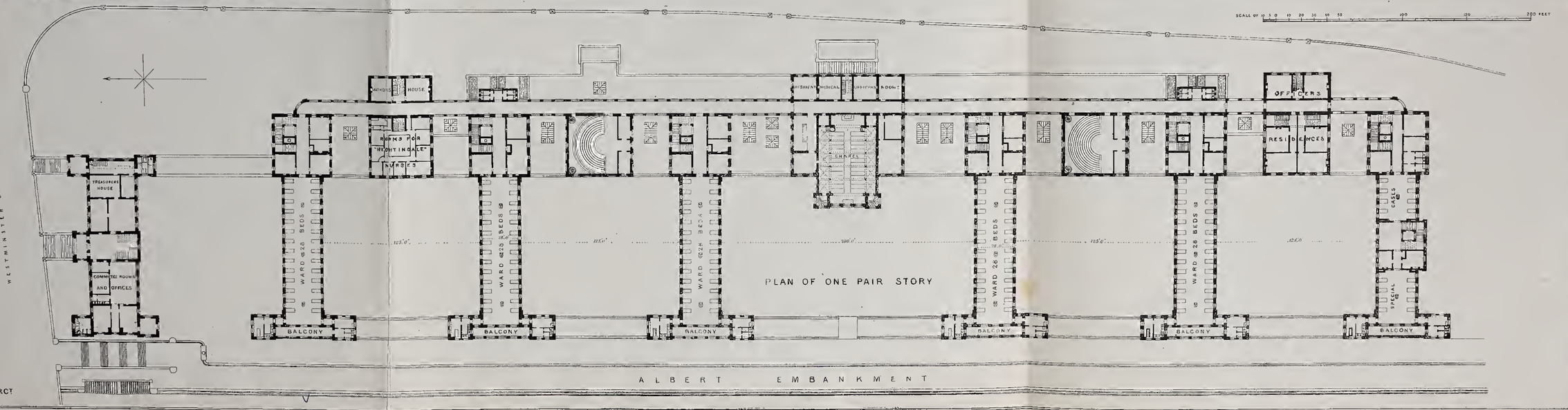

HENRY CURREY, ARCT

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VIEW OF ST THOMAS'S HOSPITAL, LONDON

Royal Institute of British Architects.

At the Ordinary General Meeting, held on Monday, 23rd January, 1871, the following Paper was read—THOS. H. WYATT, President, in the Chair:—

ST. THOMAS'S HOSPITAL, LONDON.

By H. CURREY, Fellow.

IN compliance with the request of your Committee, I have much pleasure in laying before you a brief account of the new St. Thomas's Hospital, now approaching completion on the Albert Embankment, at Lambeth. The hospital at Southwark, which had existed in some shape since the year 1207, was incorporated and received its Charter from King Edward the Sixth in the year 1551, and a few preliminary remarks on the cause of its migration from that ancient site may not be uninteresting, particularly as such removal involved many important questions, not perhaps purely architectural, but such as are continually arising in our professional practice.

In 1859 a certain adventurous railway company, called the Charing Cross Railway, conceived the idea of taking a line from London Bridge to Charing Cross, and their great difficulty appeared to be to pass the Borough without intrenching either upon St. Saviour's Church or St. Thomas's Hospital. They, however, respected the Church, not perhaps from any religious sentiments, and determined, as being most likely to succeed in their application to Parliament, on taking a small corner of the grounds of St. Thomas's Hospital, and they accordingly served a notice of such intention on the authorities. The Governors, feeling that a railway perched upon an iron viaduct within ten or twelve feet of a most important portion of their hospital, irrespective of the damaging effect it would have on the whole institution, would be destructive of its usefulness, were reluctantly compelled to oppose the bill in Parliament. After a long and arduous struggle, the Committee of both Houses came to the conclusion that there was a great public necessity for such a communication, and that the hospital must yield, and the Lords' Committee, after expressing a strong feeling on the injury which would accrue to the hospital, passed the preamble. Certain negotiations followed, but came to no result. In December, 1860, the railway company served a notice on the hospital to take the part they required. The Governors felt that a railway and a hospital could not co-exist in such close proximity, and after full consideration, gave the company notice to take the whole under the 92nd clause of the Land Clauses Consolidation Act. The company resisted such request, but on the matter being argued before the then Vice-Chancellor Wood, he, without hesitation, determined that the hospital view was the correct one, and that the company could not escape from the obligation of purchasing the whole hospital. Such being the result, one cannot but regret that the line was not taken directly across the hospital, passing through the centre of the London Bridge station, thus accommodating both the Brighton and the South Eastern lines, and crossing the High Street at a right angle instead of the tortuous and inconvenient plan which has been carried into execution at an enormous cost. Next came the question of how the compensation was to be assessed, whether by jury or by arbitration, and looking to the uncertainty which then attended the verdict of juries, it was determined to refer the matter to arbitration, and after considerable difficulty in finding a suitable umpire acceptable to both parties, Mr. John Stewart, of Liverpool, a gentleman of great eminence in such matters, was ultimately appointed in September, 1861. The

reference commenced and lasted for seven days. There was necessarily a considerable discrepancy in the valuations made on behalf of the hospital and of the railway company, the highest, on behalf of the hospital, being £478,000., and the lowest, on behalf of the company, £145,000. Mr. Stewart's award amounted to £296,000.

In 1862 the company took possession of the hospital premises, arrangements having been made by the governors for the use of the Surrey Gardens as a temporary hospital. A fire had recently occurred, burning out the whole of the interior of the music-hall, and by the introduction of new floors and roof, and sundry alterations to outbuildings, a temporary hospital was provided for about 200 beds in a very short time, and has, I think, fairly answered its purpose during the interregnum. Next came the difficult question of the selection of a site for the new hospital. The Governors had no compulsory powers of purchase, and to acquire eight or ten acres within reach of the population was a matter not easy of solution, and the question was further involved by the views expressed by certain persons as to the desirability of making it a suburban hospital. Several sites were suggested and valuations made, one being the removal of Bethlehem to the country and the occupation of that site for the purpose of St. Thomas's Hospital, and I prepared a design and estimate for a new Bethlehem Hospital to be erected at the cost of St. Thomas's. All this, however, dropped through, and ultimately the surplus land created by the Albert Embankment was fixed upon, and a contract made with the Metropolitan Board of Works for about eight and a half acres when embanked at the sum of £90,000., half of the eight and a half acres being land reclaimed from the river. Great objections were raised by some parties to the site: it has been called a mud-bank, and all sorts of uncomplimentary names, but it appears to me that a better site for a metropolitan hospital could not have been selected (always of course presuming the river to be cleared of the sewage). The great tidal flow of the river forms a powerful natural ventilator, changing the volume of air continually, and the quiet soothing influence of water, and absence from noise and dust, renders it in my opinion a most desirable locality for the purpose of a metropolitan hospital. I do not mean to imply that some breezy down in the country would not be more conducive to health, but to place a metropolitan hospital in any such distant locality would render it practically useless.

Having sold the old site, and done the best we could for the patients by the conversion of the Hall at the Surrey Gardens (which has seen the strange vicissitudes of an abode for music, a tabernacle for Mr. Spurgeon, and a refuge for a hospital), and the question of a new site being settled, I was instructed to prepare the necessary design, and as the subject of competition is one of some interest, I may mention, that on my appointment as architect and surveyor to the hospital, now some twenty-five years ago, the Governors reserved to themselves the right of submitting any great work which might arise to competition. They did not, however, avail themselves of this right, and although it is not for me to say anything as to the result of the course they took, yet I venture to think that they were relieved from some trouble, anxiety and expense, and I take this opportunity of thanking them for the confidence they reposed in me. A Committee of Governors, accompanied by myself, visited several of the Continental hospitals, and the Committee of the Medical Staff assisted in maturing the several matters of detail. The design is arranged on the Pavilion system, now generally admitted to be the best for hospital purposes, and specially suitable for the land on which the hospital was to be erected. The nature of the site did not admit of the pavilions being placed on both sides of a central court or corridor, as at the great French hospital at Lariboisière, the hospital at Brussels, or the Herbert hospital, but they all ranged on the river side of one continuous corridor, 900 feet in length. This arrangement has the disadvantage of increasing the length of communication from the several departments, but at the same time it renders the ventilation more free by diminishing the length of the courts. The prominent

defeets of the Lariboisière hospital, viz. the too close proximity of the bloeks with referenee to their height, has, I hope, been avoided. The pavilions are plaeed at a distanee of 125 feet from eaeh other, (the eentre eourt being inereased to 200 feet), whieh distanee, it was ealeulated, would admit of ample sunlight and air to every bloek, the axis of the wards being due east and west.

The general disposition of the building will be seen by refcrence to the plan of the one-pair story, on whieh the isolation of the bloeks is more distinetly indieated, the intermediate spaces on the ground story being filled in with lower buildings, for purposes hereafter mentioned ; and it was my endeavour to make the plan as simple as possible in its arrangements, for faeility of inspeetion and working. Corridors run the whole length of the hospital on the ground and one-pair stories, and eonneet the several blocks of wards or pavilions. These eorridors are lighted by large windows on both sides, and in the event of it being deemed neeessary to isolate any partieular bloek, it eould be done by putting sereens aeross the eorridors, and removing the sashes from the adjaeent windows. These corridors are not earried higher than the one-pair story, but the flat roof over forms a means of eommunieation to the several bloeks on the two-pair story. The pavilions are plaeed at right angles to the eorridor, from whieh a passage leads direet to the wards, on one side of which is the stairease. The wards are designed to be 28 feet in width by 120 feet in length, and 15 feet high, and will aeeommodate twenty-eight beds, giving a eubie eapaeity for each patient of 1800 feet. The beds are plaeed at distanees of 8 feet from centre to eentre, and the windows are arranged alternately with the beds, at a level to enable the patients to see out. A cheerful aspeet is given to the wards by the end lights eommunieating with the external balconies towards the river, where patients may be placed on couehes or ehairs in fine weather. Small wards for two beds, eontiguous to, but not eommunicating with the general wards, are provided in eaeh bloek for the reeeption of speeial eases, whieh it may be deemed desirable to separate from the other patients. Adjoining the passage are placed the sisters' room, the ward kitchen, and a room for the medieal offieers' eonsultation. The staircases are wide and easy of aseent, the treads being $12\frac{1}{2}$ inches and the rise $5\frac{7}{8}$ inehes. The well holes are oeeupied by the large lifts and ventilating shafts hereafter referred to. The water closets, lavatories and bath rooms attaehed to each ward are projected from the main building, and are eut off from the ward by intereepting lobbies, with windows on both sides. The water elosets, lavatories, &c., have also windows on all four sides, to provide a thorough ventilation. In this department the foul linen and dust shoots are arranged, eommunicating with a reeeiving room in the basement for external removal. Dormitories are provided for the nurses and servants in the attie story, eaeh having a separate sleeping eompartment, eare being taken to prevent the aseent of any ward atmosphere reaehing thereto.

The main hospital may be said to commenee on the first floor, and eonsists of three tiers of wards, there being four smaller wards provided on the ground floor for the reeeption of aeeidents, &c. The total amount of aeeommodation provided is about six hundred beds. The wards have flat eeilings throughout, and the windows are earried up to the eeiling, to ensure a thorough ehange of air in the upper part of the rooms. From the eorridors on ground floor patients will be quietly and eonveniently eonveyed by lifts to the various wards (these lifts will be referred to presently); the eorridors will also afford a plaee of exercise for the patients in wet weather, and the eovered eolonnades adjoining the river will form an agreeable lounge for patients approaehing convalescence.

The above deseription applies generally to all the pavilions, except the southernmost, whieh is designed for speeial diseases, inadmissible to the general wards. The wards in this pavilion are smaller, and are arranged for males and females, being separated by a eentral stairease. The wards on the ground story eorrespond in general arrangement, but in consequence of the main corridor on ground story being placed next the internal eourts, the wards are shortened to admit of the introduetion of the necessary rooms in connection therewith.

The general entrance to the hospital is placed in the centre, and will be approached from the Palace New Road. The entrance hall is capacious, forming the sub-structure of the chapel, and its dimensions being large will be found convenient for the reception of the patients' friends at the times appointed for visiting. The steward's or superintendent's offices are placed immediately in front of the entrance hall, so that everything passing in and out of the hospital will be under his immediate supervision. From each side of the entrance hall branch off main corridors of communication connecting all the different departments. The ground floor of the first pavilion to the left is appropriated to the kitchen department, as being as nearly central as possible. It comprises kitchen, scullery, and cooks' rooms, with larder, bread room, &c., on the basement immediately under. A serving place is provided, where the patients' food will be distributed; it will then pass along the corridor to the different pavilions, and be conveyed up a small lift to the different wards. The ground floor of the first pavilion to the right is appropriated to the matron's department, with a commodious room for linen stores. On the right of the entrance hall is placed the principal staircase which leads direct to the corridor on the one-pair story, and will be used by visitors to patients, or for the general purposes of the hospital. It communicates directly with the resident medical officer's apartments, which are placed in the central block, consisting of sixteen rooms and a common room. Two operating theatres are provided (communicating with the corridors) lighted from the northern slope of the roof, and of ample dimensions to admit of a large attendance of pupils. A private room is attached to each theatre for the operator, with a second room in which a patient may be temporarily placed after an operation. Conveyance to the mortuary will be provided from the basement by an underground passage without exciting the patients or the public observation. The dispensary and surgery are placed conveniently for the service of the hospital into the main corridor, and of the out-patients (who are more particularly referred to hereafter), from the opposite side. The laboratory, drug and store rooms are placed in the basement story immediately under the dispensary.

All applicants for relief at the hospital will enter at the covered porch in Palace New Road, and will be received in one of the admission rooms according to sex; they will then be informed whether they are to be admitted into the hospital or to be treated as "casualty patients," or as "out-patients." If admitted, they will be passed through the hospital corridor to the wards. If "casually," they will pass to the respective waiting rooms for males or females, from thence into the male or female surgery. They will procure their appliances at a window immediately contiguous, and pass out at once. If the applicant is to be treated as an out-patient, he will be directed to the out-patient department, which is placed in the corresponding wing. The out-patients enter at a door towards the southern end of the hospital, and pass through a large waiting room, 110 by 37, in which they will be arranged and classified. The physicians' and surgeons' rooms are ranged parallel with this room. Having been seen by the physician or surgeon, the patients pass into a second room, where they will wait for medicine or appliances from the dispensary and surgery windows, and after receiving them, pass out into the Palace New Road, without entering the hospital corridor. A staircase leads direct from the out-patients' waiting room to the out-patients' baths, which are provided in the basement. Sufferers from accident arriving will be conveyed directly into the accident receiving room, and from thence, when the cases are serious, immediately through the hospital corridor to the wards, and cases of accident on or in the neighbourhood of the river may be brought to the hospital and received from the landing stairs.

The administrative offices are placed next Westminster Bridge, and be approached therefrom; they will comprise the governor's hall, committee rooms, almoner's room, counting house, receiver's room, strong room, waiting rooms, and offices for the clerk and surveyor of the hospital, the treasurer's residence, &c. A staircase will connect the treasurer's house with the main corridor of the hospital.

The two lower stories of this block will contain residences for porters. Four houses are provided for resident officers, containing eight rooms each, exclusive of domestic offices. They will be approached from the Palace New Road, and communicate in the rear with the main corridors of the hospital. For the last eight years, nurses selected by Miss Nightingale have been trained (the governors believe with great advantage to the public) in St. Thomas's Hospital; and in the design for the new hospital, provision has been made for an increased number. The training institution adjoins the matron's residence, and will afford accommodation for forty probationers, who will be trained to the hospital wards for the council of the Nightingale Fund. Each probationer is provided with a separate sleeping apartment, ranged round a central gallery, with all necessary bath rooms, &c., and a large day and dining room on the ground floor.

The chapel is placed in the centre of the building, communicating with the corridor, with convenient access for both sexes. The school buildings occupy the southern end of the site. They consist of a large museum, 85 by 30 and 34 feet high, with two galleries, a museum for chemistry, and materia medica, medical, anatomical and chemical lecture theatres, library and microscope room, dissecting and post mortem rooms, chemical and pathological laboratories, &c., affording the medical student opportunities rarely, if ever, equalled in completeness. The extreme point is occupied by gardeners' sheds, stables, &c.

The new wall enclosing Lambeth Palace grounds was built at the expense of the hospital in exchange for certain pieces of land surrendered by the late Archbishop of Canterbury to improve the boundary of the hospital site.

The designs were completed in June, 1865, and were exhibited to the Governors and others interested in the subject at the London Bridge Hotel for some weeks, and were ultimately approved by the General Court of Governors and by the Court of Chancery, whose sanction under a special Act of Parliament it was necessary to obtain. In April, 1866, the contractor for the Embankment having made considerable progress with the river wall, and being about to commence filling in and levelling the site, I reported to the Governors that it would appear most desirable that the foundation of the hospital and the embankment works should proceed simultaneously, and thus avoid the great expense of excavating and removing the material which was about to be filled in, and save a considerable amount of time in preparing the foundations, while the necessary details and contract for the superstructure were being prepared. A contract was made with Mr. Webster for the foundation works, and he at once proceeded vigorously with the same on the foreshore, but great difficulty was experienced in obtaining possession of the several properties which fringed the bank. The building stands partly on land reclaimed from the river and partly on the shore. The foundations on the river portion are carried down to the London clay. Those on the shore stand on a sound bed of gravel, which overlays the London clay, the difference in level being obtained by wide steppings, as shown on the sections. The ends of the blocks next the river have a solid foundation of about 22 feet deep over the entire surface, forming a toe to the whole. The long flank walls of the pavilions have a foundation 10 feet in width, and the same depth, 22 feet, up to the old river wall. The concrete is then stepped up, and a platform of concrete, about 5 feet deep, is laid over the whole surface of the remaining portion of the building. The land or spring water stands at a level of about 4 feet above the clay. A drain was laid along the whole length of the hospital at the back of the river wall to a sump, and the excavations were all pumped dry before the concrete was put in. The whole of the concrete is composed of blue lias lime and clean Thames ballast up to a little above the land water line in proportion of six to one, all above that in the proportion of eight to one. The strata on the shore consisted of made ground, then gravel varying in compactness, resting on the London clay, which rises gradually up from the river. The

strata on the river portion consisted of loose and sandy gravel down to the clay. The Embankment wall is also carried well down into the clay. As regards the terrace wall which intervenes between the end of the hospital blocks and the Embankment wall there was no weight of superstructure to carry, but it was necessary to go down to the clay to get any thing like a bottom. To have carried the whole down would have been very costly. It was therefore determined to build it on piers and arches. These piers were carried down 5 feet square in concrete, six to one as before, and arches turned from pier to pier in Portland cement concrete, in the proportion of five to one, the ballast being fine and small. The arches were turned on box centres, which were shifted from time to time as the concrete hardened, and the ground filled in all round. Two or three of these arches were turned in Coignet's beton as an experiment, but the Portland cement concrete was found equally strong and cheaper. The foundation of certain portions of the low outbuildings at the extreme end of the ground are executed on the same principle on piers and concrete arches; I am glad to state that owing to the care with which the foundations generally were put in and the superstructure raised, I am unable to discover the slightest settlement over the whole area of the extensive building. Scarcely any relicts of antiquity were found in the excavations.

During the execution of the foundations the working drawings and specification for the superstructure were completed, and the bills of quantities were prepared by Messrs. Strudwick and Co. and Mr. Richard Roberts, and tenders were received on July the 18th, 1867, from fourteen of the most eminent builders, the amounts ranging from £382,000 to £332,748, which latter was submitted by Messrs. John Perry and Co. of Stratford, and which after full consideration was accepted. Had stone ashlaring been used instead of red bricks the additional cost would have been about £25,000, which the Governors did not feel justified in incurring, and which, personally, I see no reason to regret. The contract was settled in October, 1867, and the contractors commenced erecting stone sawing machinery, laying down tramways, and making other preliminary arrangements, and on the 13th of May, 1868, Her Most Gracious Majesty laid the first stone. The ceremony was conducted with much state in the presence of 3000 spectators in a pavilion erected specially for the occasion, and the arrangements appeared to give general satisfaction. The stone laid by the Queen forms the north-east angle of the substructure of the chapel, and stands above the ground-floor line at the foot of the public staircase.

I will now proceed to state a few details of the construction, the warming and ventilating arrangement, and the cost. The footings were built with what is technically known as No. 2 wire cut Galt bricks, and the specification provided that the walls generally were to be built with the very best stocks, but that the piers in the flank walls of wards were to be built with Galt bricks, for reasons which I will presently describe. Owing to the great difficulty in obtaining a satisfactory stock brick in such quantities as we required, the contractor found it to his advantage, considering the small amount of fracture and waste, to use Galt bricks, and the whole of the work is executed in that material. They make excellent good sound work, but unless the joints are left very rough on the edge they do not afford so good a key for plastering as ordinary stocks. The greater portion were supplied by the Burham Brick Company. Inverted arches are turned under all window openings above the footings, and the piers in flank walls of wards being reduced to a small area by the large window space desired, and having to bear on the ground story an accumulated weight of 110 tons, were carried up with the very best Galt bricks in Portland cement, with Portland stone bonders the whole size of piers, introduced at every four feet in height. Every alternate window in basement was omitted with a view to obtain a larger area of piers on that story. Hoop iron bond is introduced at the level of each floor where it runs continuously round the building without any necessity of severance. The area walls, 14 feet in height, were built as shown on plans and sections, with a view to resisting the great pressure of earth filled in at back,

and to preserve the facing from being disfigured by percolation, the base of the pockets being filled in with concrete. The building is faced with red bricks, and great pains were taken in ascertaining the best quality for the purpose, and none appeared equal in quality and colour to the Fareham brick. Negotiations were therefore entered into with Mr. Cawte, of Fareham, in Hampshire, who opened a new field adjoining his old works, and made special arrangements for supplying the quantity required. The bricks were put into vessels at his yard, and brought alongside at Westminster, thus avoiding the damage and breakage of railway transit and carting from station. They were made specially, and the size so arranged as to bond accurately with the Galt backing. The bricks are excellent both in colour and quality, and Mr. Cawte used every exertion to keep us supplied with material as the work progressed. The number of bricks consumed exclusive of the facing bricks has been about twenty-five millions. The stone used is for the most part brown Portland, from Messrs. Hollands, Waycroft and Maggott quarries. No. 17 saw frames, besides hand saws have been constantly at work, sawing the material, and the capacity of these saws appear to have been the guage of the progress of the structure. Steam moulding machinery and large rubbing beds have also been used to a considerable extent. The quantity of stone used has been about three hundred and seventy thousand cubic feet. The consoles under main cornice, the caps of columns, and pilasters, the balusters, and the vases and terminals on balustrading are executed in Ransome's concrete stone. The material appeared peculiarly fitted in the present case where there was necessarily a great repetition of the same model, and consequently a considerable economy. Had it not been for this useful material I should probably have had to be content with the long line of balustrading unbroken by any vase or terminal. The pedestals would have remained vacant as they do in many instances were designed for sculpture, but the sculpture never arrives. It harmonises well with the Portland stone, and although many of my professional brethren would hesitate to use any artificial material, I venture to think that such hesitation may be carried a little to excess. The floors and flat roofs are constructed with wrought iron girders and "Dennett" arching. The latter material, as you are well aware, is composed of broken bricks or stone and sulphate of lime, in the proportion of three of brick to one of sulphate of lime, spread as concrete on a centre; a large quantity of the slag from the potteries at Lambeth has been used, and forms an excellent material for the purpose. The spans are for the most part eight or nine feet, the thickness at the crown being four inches, increased to about nine inches at the haunches.

The drawings shew the construction of the floor of the wards. It was thought desirable throughout the wards to have flat ceilings, but throughout the corridors and a great portion of the hospital the arches and girders are left to show the construction, the soffits of the arches being finished with a setting coat of plastering. The joists and sleepers, or concrete and paving, are laid on the top of the Dennett arching in the ordinary way. The wagon headed ceiling of the chapel, and the groining of the aisles is also executed in the same material, the aisles having stone ribs. The thickness in the panels is five inches and in the stiles ten inches. The reason which induced me to adopt this mode of construction for the Chapel roof was not only the satisfaction of having a real sound solid construction, but it afforded an opportunity of carrying up several flues to the apex of the roof which must otherwise have cropped up in an objectionable mode on the balustrading. The flues are carried across the groining of aisles on the back of the main ribs, then up the piers of clerestory walls, and again on the back of the main roof, provision being made for sweeping at certain points easy of access. I may here mention that the flues from all the low buildings are taken across the corridor ceilings, and carried up with the main building, thus avoiding all risk of smoke and disfigurement. The ceiling of the Governor's hall is constructed with iron girders and Dennett arching for the same reasons. The flues for the rooms on the lower floors had to be disposed of, and instead of interfering

with the parapet and balustrading were carried over the back of the cove, and taken out of the roof in the ordinary way. The "Dennett" material is certainly very handy in execution: it accommodates itself to any form of arch or groin: it is strong, has great resistance against fire, and when set, does not exert any lateral pressure, but care must be taken, and a liberal allowance made for expansion during the process of setting. I believe it is as cheap, if not cheaper than any other fireproof construction. The superficial area of arching used at the hospital in floors and flats is about three hundred and thirty seven thousand feet.

The rivetted iron girders, of which there are about 1,250 tons, were made in Belgium at the Sclessin Works, and although not quite so neat in finish as one could wish (many being exposed to view), yet at the same time they are composed of excellent material, and stood the proof tests well. They were delivered very regularly, and the delay which so often occurs from the non-delivery of iron-work was avoided. The flat roofs over low buildings and corridors, which in many parts form terraces of communication, are constructed in a similar way. The surface of the arching is covered with concrete, laid to the required fall, and then covered with asphalte—"Pilkington's Patent," which consists of the introduction of a layer of felt between two coats of asphalte. The lower coat is laid in Polonceau, about half inch thick, and the upper coat in Seyssel, half inch thick, with flashing of the same material. The whole, as well as the paving in the basement, has been executed by Mr. Pilkington, in an excellent manner. The paving and channel stones used in the areas are the Patent Victoria Stone, composed of granite chippings and Portland cement cast in moulds, and indurated by a process somewhat similar to Mr. Ransome's. It forms a capital paving, and a considerable saving has been effected by using it in lieu of rubbed York. The traffic in the areas is of course unimportant, but the paving in question has been severely tested in the Poultry and on Blackfriars Bridge and is standing the test well. The corridors are paved with tiles one foot square and inch thick in alternate squares of red and buff, with black borders. They are executed in Ransome's material, specially indurated, and when one considers that this material is found most effectual as a grindstone, I am induced to expect that it will stand the effect of friction as well, if not better, than any natural stone. The cost of such paving bedded and jointed in Portland cement is very moderate. The quantity required will be about 30,000 feet, and I do not think so good an effect could be produced in any other material with equal durability at so small a cost. The floors of the wards are laid with wainscot as being non-absorbent, and the walls are plastered with Parian cement with the same object. It has been endeavoured to incorporate a tint with the finishing coat of the Parian, with a view to avoid the glare of the natural white colour, and of painting hereafter. Certain experiments were tried, and it was found that with a backing of Portland cement and a setting coat only of Parian, a more uniform tint was produced than by using Parian throughout. Although great care has been taken in the manipulation, the result is not wholly satisfactory. Had we been able to wait until the walls were more completely dry, a more uniform tint would probably have been produced.

The ward windows are constructed in three divisions, as shown on the drawings, the lower part being hung to open in the usual way, and the upper sash drops to the depth of the transom, wich is quite sufficient for clearing the upper statum of air in the wards. The whole of these sashes and frames, and the greater portion of the doors were made in Sweden by the firm of Messrs. Ekman. My assistant Mr. Harris went purposely to Sweden to inspect the works, and brought back a most satisfactory report of the machinery, drying chambers, and general capabilities of the establishment for turning out good work, and the result has fully justified the confidence placed in them.

The ground floor of one of the pavilions has been used up as a drying room, by building up temporarily the various openings in which all the floor boards and other joiner's work have been thoroughly seasoned. One of the many newspaper critics seeing these openings built up, regretted that the

Governors were unable to utilize the whole of the Hospital, and that some of the wards had consequently been built up. A little enquiry would have enlightened him and explained the reason of the temporary blockade.

In designing the joiner's work, all moldings and quirks have been dispensed with as far as possible, as such parts only afford harbour for vermin. The wainscot floors are tongued with hoop iron, the nail holes stopped with colored putty, and prepared for waxing and polishing. The windows of the pavilions are glazed with plate glass, with a view to a more equal temperature, and the corridors are glazed with flatted crown.

The warming and ventilating arrangements are indicated to some extent by the drawings exhibited this evening. It was determined to depend as much as possible on natural ventilation, avoiding all costly arrangements and fanciful theories, at the same time providing the means of changing the air during cold and boisterous weather and at night. The main extraction shaft is carried up in the well-hole of the staircases, and in this is placed the smoke-flue from the boiler, consisting of a wrought iron tube 15 inches diameter. The boilers for warming purposes would not of course be available in the summer, but the furnace for the supply of hot water and baths would be continuous in its operation. In the upper part of this shaft are also placed the hot water cistern, and if found necessary, hot water coils will be added to assist the rarefaction. Shafts are carried from the ends of all the wards, both at the ceiling and floor level, and from the centre at the stove shaft hereafter mentioned, communicating with a horizontal trunk in the roof, which trunk is connected with the heated shaft previously referred to. To replace the air thus extracted, fresh air is introduced by means of zinc tubes laid between the "Dennett" arching and the floor boards communicating with the stoves and hot water coils, thus passing over a cool surface in summer, and tempered in winter by contact with the heated surfaces before entering the wards, the whole admitting of regulation by valves. Each pavilion has its independent means of warming and ventilating, avoiding as much as possible all complication in the arrangement, but the pipes are so arranged that in the event of a break-down in any one block, its neighbour can come to its assistance during its temporary failure. A chamber is formed under the ceilings of the corridor in basement and ground floor, into which the whole of the rooms in the low intermediate buildings forming the out-patients' and casualty departments are ventilated, and this chamber communicates at each pavilion with the main extraction shaft before described. The wards generally are warmed by three open fire-places, aided in cold weather by an auxiliary system of hot water. The corridors and staircases are also warmed by hot water. The open fire-places stand in the middle of the wards with vertical shafts. These fire-places might have been arranged against the outer walls, but bed space would thus have been sacrificed. The stoves might have been placed as they are, but with descending flues to the outer walls. This, however, would have involved great complication in the arrangement, risk of smoke and difficulty in sweeping, and the piers already small enough would have been so riddled with flues that they would have been unequal to carry the weight imposed. It was therefore thought best to carry up a vertical shaft throughout. It may detract somewhat from the appearance of the wards, but it has, I think, great compensating advantages. The shafts are constructed, as shown on the drawings, with an outer case of cast iron, and an inner wrought iron smoke tube 15 inches diameter. The hot metal does not, therefore, come in contact with the atmosphere of the wards, but the space between the two tubes becomes an efficient ventilating shaft, which is connected as before with the main trunk in roof. The smoke tube is carried down to the basement, and will be swept from below without disturbing the wards. The whole arrangement is capable of easy removal for repair. A cast iron socket is built into each floor, supported on two small bearers running from girder to girder, and the "Dennett" arching is made good to the same all round, thus avoiding any communication from floor to floor. The outer casing

is of cast iron, put up in pieces and bolted together, and is easily removed at any time should it be necessary to repair the smoke tubes. In the upper story the iron casing is discontinued, and a brick casing built on the concrete floor, which is more convenient for passing through the roof and carrying the external shaft. It will be observed that the three stoves go into one flue. This is made of ample dimensions, and a valve is provided at each stove to close the connection with the flues when the stove is not in use. As far as it can be tested in the present unfinished condition of the work the arrangement works satisfactorily. The stoves are formed with an air chamber at the back, having a large heating surface of metal (but which cannot be heated sufficiently to vitiate the air) standing in a pan of water, somewhat similar to the Gurney stove. The ventilation of the water closet and lavatories is entirely independent of the wards, and is carried up the shaft in the river turret, in which are placed the hot-water tanks for supply of baths and coils. The stone shafts at the angles form the termination of the foul linen and dust shoots, which are carried right up to the external air. The ventilation of the museum and school buildings is on the same general principle, the ventilating and smoke shaft being contained in the tower at the southern end of the building. The whole of the warming and ventilating works have been most satisfactorily carried out by the well-known and experienced firm of Haden and Son, of Trowbridge, and I am glad to bear testimony to their ability and the careful and considerate attention to all works entrusted to them.

The risk of fire is reduced to a minimum, but considering that an alarm even of fire would act most injuriously on many cases, a system of fire mains and cocks is provided throughout the building. The cocks admit of being served either from the rising main or from the large tanks provided in the towers. A special main has been laid by the Southwark and Vauxhall Company to supply the building, and a constant service will, it is expected, be supplied; but in the event of any accident happening to the main, provision is made by an arrangement of back valves to supply the fire cocks from the tanks. These arrangements have been carried out by Messrs. Shand and Mason, whose name is a guarantee of their efficiency. The gas services have been executed by Messrs. Strode, and although not calling for any special description, I may say that they have been carried out in the usual satisfactory manner by that firm.

The lifts, of which there are one to each pavilion, demand a few words of explanation. They are constructed upon the hydraulic ram principle. A boring was made to a depth of 70 feet, and lined in the usual manner for about 22 feet through the gravel with cast iron cylinders to keep back the water, and from this point to the bottom through the clay the well is lined with brickwork. In this well is sunk a cast iron cylinder, 11 inches internal diameter, strongly bolted together in 9 feet lengths: and within this again comes a hollow ram, 9 inches diameter, working through this cylinder, screwed together in 9 feet lengths. On the top of the ram the ascending room is attached, consisting of a strong iron frame with iron roof, all strongly trussed together and lined with match boarding. At the top and bottom of this room, on each side, are V guides, lined with gun metal, the top ones having springs to prevent oscillation or sudden shocks. At each side are suspending irons, to which are attached strong chains passing up a groove in the brickwork and over wheels, 3 feet 8 inches diameter, to the counterbalance, on each side; these counterbalances work in recesses, and are grooved to run in guide irons. The guide bars for the ascending rooms are of cast iron, placed the whole height to ensure a steady movement. A gear rod passes through the cage to control the lift, and self-stopping gear is attached. The lifts are worked by fall of water from large tanks fixed in the roof of each block, 104 feet from basement, each tank containing 2,500 gallons. The stroke or rise of each lift is 63 feet. The pressure of water is 45 lbs. per square inch, and the lifts are calculated to raise six persons each time. This principle has been adopted as affording the most perfect safety attainable. The over-head gear is placed at the sides in a chamber specially provided, so that in the event of any fracture thereof, no damage would arise to

the cage. There is also one food lift to each block. They are upon the rack and piston principle. The machinery, which is in the basement, consists in each case of a cylinder, 11 inches diameter, with piston and rack working in it, with tooth wheel and large drum wheel, on which is coiled the wire lifting rope, passing to the top of the building and over a one-grooved pulley to the cage, which has guides top and bottom; this cage runs in T iron guides, fixed in each side of walls, from top to bottom of lift hole. A separate wire rope is attached to top of cage, passing over grooved top wheel to the counterbalance, which is also guided on each side by angle iron guides. The lift is worked by a rod passing up at the corner and communicating with the valve at bottom. The weight intended to be raised is 1 cwt. The height is 63 feet, and these lifts are worked from the same tank as the passenger-lifts. They are easily controlled at any floor, and stop themselves at the highest and lowest points. The whole of the lifting apparatus has been specially designed and carried out by Fred. Colyer and Co., Engineers, St. Mary's Iron Works, Leman Street, London, the whole of the work being of the most substantial character, and nothing has been neglected to ensure thorough efficiency, combined with perfect safety.

The electric communication has been executed partly by Messrs. Reid, Brothers, of the City Road, and partly by Messrs. Moseley, the ornamental ironwork by Messrs. Skidmore, and the cooking arrangements by Messrs. Benham and Son.

In conclusion allow me to say a few words as regards the cost. The ultimate cost exclusive of the site will probably be about £400,000., including foundations and fittings, or £650. per bed, which in the absence of any detailed explanation appears to be a large sum; but if all extraneous buildings are allowed for, and the cost of one pavilion taken, which accommodates 111 beds, it will be found that the amount would be reduced to £250. per bed, and considering the cubic allowance of space, the number of attached rooms provided and the character of the work generally, such amount does not appear to me to be excessive. The cost of the building, exclusive of the concrete foundations and the enclosure railing, is about 9*d.* a cube foot. The contract among other things provides a large medical school building, a building for the training of nurses, large administrative offices for the civil department of the hospital, five residences and extensive out-patients department, and the enclosure of $8\frac{1}{2}$ acres of land, with stone curb and iron railing and parapet walls.

I have now only to bear testimony to the excellent manner in which Messrs. Perry have carried out the work, and to thank Mr. Bullivant, the Clerk of Works, and all parties who have assisted me, for the zeal and ability with which they have performed their several duties. I fear I must have exhausted your patience by the dry details which I have brought before you; but whatever may be the architectural merits or defects of the building, the magnitude of the structure, and the important position it occupies, renders it perhaps not altogether an unfit subject to be recorded in the Transactions of the Institute. At all events you will I am sure agree with me in the expression of a hope that it may be effectual in alleviating the sufferings of the poor, and in advancing the noble arts of medicine and surgery.

The PRESIDENT.—Whatever difference of opinion there may be relative to the merits of the pavilion or other form of hospital, or on the vexed questions connected with this subject, nobody can doubt the thought, and care and study, which Mr. Currey has bestowed upon it, and we are much indebted to him for the trouble he has taken in putting on paper a very comprehensive and consecutive detail of this most interesting building. There are several gentlemen present (and amongst them members of the medical profession) who have paid a great deal of attention to this subject and have shewn great interest in it, and I hope they will be good enough to give us the benefit of their remarks.

Dr. BALFOUR, Visitor (responding to the President's invitation) said.—Since you have done me the honor, Sir, to call upon me to speak, allow me in the first place to thank you for having given me the

opportunity of hearing so able and interesting a paper: and in the next place, to thank Mr. Currey for having kindly given me permission personally to inspect the building to which it refers. I have but little to say, except that I was much struck with the great care taken to provide for all the requirements of the medical staff and the schools of the hospital, and the foresight shewn in the arrangements for placing the patients in circumstances most likely to conduce to success in the treatment of their diseases. Perhaps it is the highest compliment I can pay Mr. Currey, to state that on one point only did I find anything that did not fully come up to my expectations; and that was in respect of one portion of the system of ventilation. I am not prepared to endorse the opinion that the plan of ventilation by shafts in the centre of the wards is perfect, because I fear in summer time, when the fires are not burning, and consequently when there is no heat in the centre tube, the foul atmosphere of one ward may possibly get into another. As I did not see the drawings of that part of the plans which relate to the arrangements for the ventilation by means of these tubes, I may be speaking under a mistake; but so far as I could judge, there is nothing to prevent the foul air of one ward getting into another, if there happens to be a difference of temperature between the two, or a current of air passing through one of the wards, which might have the effect of drawing part of the supply of air for the ward from the tube. But as that is the only point on which I differ materially from the architect, I may be permitted to repeat, that the whole of the arrangements of the hospital and school appear to me to be of the most satisfactory character.

Mr. EDWARD HALL, Visitor.—I think Mr. Currey has not quite correctly described the arrangements of the Lariboisière Hospital in Paris. That hospital has the ward-blocks and other buildings all surrounding a central court; whilst, I believe, Mr. Currey described the ward-blocks as extending right and left of, and at right angles to, a long connecting corridor. The latter arrangement has been carried into effect in two or three hospitals in Great Britain,—the first case in which it was adopted being the Infirmary at Blackburn, which I visited at the time: but the Lariboisière plan is that of a central court, with corridors all round, and with the administrative buildings at the ends, or north and south, and the ward-blocks extending east and west. I think it probable that that arrangement is worth a little more attention than it has received in this country, because the plan is considerably more compact, and it is possible to place the kitchen in a more central situation. There is another point in connection with hospital-construction which is worthy of consideration—that is the advantage, or otherwise, of coating the walls of the wards internally with Parian cement. At the time when the question of the construction of hospitals was assiduously discussed in this country, it was considered by many that Parian cement was the best material, and that in all cases the endeavour should be made to have highly-polished surfaces to the walls: but in a very important hospital, that of the Chorlton Union, near Manchester, the walls were coated with lime-white. In that case, the reason was, that the funds would not allow Parian to be used: but it has been suggested of late years, that it would be very much better to avoid the use of Parian cement (which, good as it is, is said to be liable to absorb miasmas), and that if lime-white were adopted, it would be possible to renew the coating, whilst, moreover, the lime-white would be a preservative from infection,—which Parian cement would not be. There are many other points which Mr. Currey, perhaps thinking that we were pretty well acquainted with, only touched upon. The question of cubic feet of space is an important one; and I think that Mr. Currey has given a larger number of cubic feet per patient in his wards than has been given in any previous building. With regard to distance of ward-blocks from one another, that is important in connection with this building; because though the distance is greater than in any previous case, yet in consequence of the height of the blocks in St. Thomas's Hospital, the question of sufficient distance for a like building, is one which may be worthy of distinct consideration.

Dr. FITZGERALD.—I can only say, I went over this building to-day, and was very highly pleased with all I saw. I was myself educated at University College, and this hospital appears to me to bear very favourable comparison with it.

Mr. BRUDENELL CARTER, Visitor, said.—Mr. President, you have been so good as to invite the expression of opinion from members of the medical profession, and I have had the advantage not only of hearing Mr. Currey's remarkably lucid paper to-night, but on more than one occasion of accompanying him over the building, and I have watched with interest its progress from its early to its present advanced stage. Shortly after the construction of this hospital was determined on, a note of alarm was sounded by a great medical authority now no more, regarding the building of hospitals as permanent structures. The late Sir James Simpson expressed his fears that hospitals in the course of years became saturated with the miasmas thrown off by the sick, and stated that the best way to construct hospitals was to build them in a rough and temporary manner: so that after a certain period they might be taken down, destroyed, and another building erected on a different site, and built in a similar way to the first. The great weight of Sir James Simpson's name attached more importance to this statement than I think was warranted by the arguments and facts advanced in support of it; and as St. Thomas's is the first instance we have since the publication of this statement, of a hospital seemingly calculated to endure as long as this city, it will be satisfactory to the architect to hear that it is the opinion of the medical profession generally that Sir James Simpson sounded an unnecessary note of alarm, which I believe no facts will justify, and that with proper attention to disinfection, and cleanliness and ventilation, this great building may be kept for all time in a state of as perfect wholesomeness as on the day when it is first occupied. My colleague, Mr. Holmes, has published an article in the *Lancet*, upon the views of Sir James Simpson on this matter, which I think the architectural profession will read with pleasure as bearing upon this point. The use of lime white as a coating for the walls of the wards has been referred to, and a notable instance of this is afforded by the hospital at Hampstead, which was erected by the Parish of St. Pancras, and has passed into the hands of the Metropolitan Asylum Board. In that case it was done as a matter of economy, and I think with due care in proper cleansing it is possible that no harm may arise from it. We must remember, however, that such walls cannot be kept clean by frequent washing. They must be scraped, and we learn by experience that the disturbance of accumulated morbific matter by scraping is a process attended by many and serious dangers. Like Dr. Balfour I have no criticisms to offer upon the smaller details of the building. I may venture an opinion that according to the present arrangement there will not be sufficient light in the operating theatre; that I imagine is a point of detail that can be easily remedied. We know that surgical operations require a good deal of light; and in this case I think, owing to the great height of the roof, that a larger sky-light will be required before the surgeons feel at home in their new operating theatre. I would heartily congratulate Mr. Currey on the success of his building, which I trust will fulfil the high purposes to which it will be devoted, prove a blessing to the classes for whose benefit it was instituted, and promote the advancement of medical science in this country.

Professor DONALDSON, P.P., Hon. Sec. For. Corr.—Mr. President, from your great experience in this class of buildings, and from the description given by Mr. Currey, you will, I am sure, recognise the deep study which he has bestowed upon this important building, and congratulate him on the success which has attended its execution. It is quite true that it differs in some particulars from the Lariboisière Hospital, but the same principle is mainly carried out. From the great length of the plot of ground it was impossible to compress the arrangement into a square shape with a central court. The criticism on the part of the previous speaker with respect to the supposed insufficiency of light in the operating theatre can be easily remedied by the enlargement of the aperture, the light being in

the right place—viz., direct from the sky on to the object to be operated upon. I beg to propose that we tender our best thanks to Mr. Currey, for the very lucid and instructive description of his noble hospital, with which he has favoured us.

Professor KERR, Fellow.—I have very much pleasure in seconding the vote of thanks. We must have all felt whilst Mr. Currey was reading his paper that he is a singularly happy man. For him to have got through his great work without, as far as we have heard a single difficulty, is a circumstance so unusual in our profession, that we may congratulate our friend not only upon his own good fortune, but also upon the credit thus conferred upon the profession which he represents. The reason of this may partly be that our friend has had a commission so very liberal in its character; but he has also brought to bear upon the execution of it not only a very thorough acquaintance with the subject, but a certain straightforward mode of doing business, and the avoidance of a certain straining after effect, which two considerations go very far, as we see by the example of our friend, to ensure success. The description he has given shews that he has had, from the foundation to the summit, but one object in view, viz. to do the work with the utmost substantiality, and the utmost simplicity, and I think never in the course of my experience have I heard or read a description of a building carrying more completely to my mind the appearance of its having been done well and to the very best purpose. The site is of course one which has afforded our friend great freedom with regard to space,—a thing which too seldom falls to the lot of an architect designing a large building of this class. He has availed himself of that freedom of space in a most intelligent manner, and I think, from what I hear, that public opinion is universally inclined to consider this hospital to be a *chef-d'œuvre* of its kind; so that, in fact, it may be called one of the most popular works of the day with regard to its efficiency and the likelihood of its proving to be a success for many years to come. There is one point on which I should like to say a word, more particularly as I see my friend Mr. Ransome here, whose name has been so often mentioned in this room with great respect for the intelligence he has displayed in his invention of artificial stone. I would say a word with regard to Mr. Currey's use of artificial stone in this building. I confess once or twice, when I have heard the matter mentioned, I have felt inclined to doubt whether Mr. Currey was wholly justified, from an architect's point of view, in using the artificial stone in such a building; but after the description he has now given I for one am perfectly satisfied that the use he has actually made of it has fulfilled the proper intention of the material, and that he need not fear any architectural criticism which may be opened on the point. If I understand aright the capitals of the Corinthian columns are all of artificial stone; and I may take leave, for the credit of a most ingenious and enterprising man, to mention an incident which occurred with regard to these capitals. A certain stone carver had been promised, as he considered, all the carving work on St. Thomas's Hospital. He went on the ground one day, and complained that he was being badly treated, because that promise was not being fulfilled. The clerk of the works, who received him, did not understand what he referred to, until the carver explained himself thus: "Those Corinthian capitals which are beginning to be fixed are not carved by me." The clerk of the works acknowledged the fact, and desired that he would accompany him to a certain shed where he would see the whole number of capitals all ready for fixing. The carver had of course been misled by the resemblance of the artificial stone to the real Portland at a little distance; and he had now to acknowledge that he could with difficulty discover the difference close at hand. Now imitation so complete as this is to my mind perfectly fair and right; because what our friend manufactures is truly *stone*, not after the old mode of mere cement imitation and superficial resemblance or deception, but a legitimate substitute of sound structural character. I believe these capitals, for instance, are solid, or very nearly so, and they may fairly be said to be equal in all respects to natural stone. Mr. Currey mentioned the circumstance of this stone being superior to the natural

material in the form of grindstones. That is very remarkable. As has been remarked before in this room, Nature dose not undertake to find us in grindstones; and we may therefore now go on to say that Nature is not to de discredited because of having suffered defeat in the field of grindstones at the hands of the ingenious Mr. Ransome. But I am pleased to hear that Mr. Ransome has now invented another description of stone, which seems to be superior to this; so that if Mr. Currey had waited a little longer he might have had to tell us of a material even better than that which he speaks of so favourably as he does. I have seen specimens of this new stone of the same kind as Portland; and I think when they come to be submitted to the Institute presently, you will be surprised at the extraordinary success of Mr. Ransome's new invention, which extends to the imitation not only of plain stone but to marbles. I understood Mr. Currey to say that his corridors are paved with Mr. Ransome's stone. This seems to me to be well worthy of consideration. We are all acquainted with tile paving, and for ornamental work perhaps nothing is better; but for paving on a large scale I understand Mr. Currey now to say that this artificial material is superior to York stone at any rate, and not merely economically but for wear. It is not a laminated stone like York, and that is perhaps the reason; but I should like to hear from Mr. Currey whether he thinks it equal as paving to Portland. Very important questions of hospital construction have been raised and ably discussed by medical gentlemen present. That which bears upon the question of the best wall surface for the wards has been brought out in a very interesting way. Some of us who have not given much attention to this particular point might have suggested that the ordinary rule might be applicable to hospitals; that Parian cement with polished surface, being non-absorbent, is liable to certain disadvantages with regard to the moisture from condensation: but gentlemen have to my mind so explained the propriety of using the polished surface that it seems perfectly satisfactory. I beg most cordially to second the motion of a vote of thanks to Mr. Currey for his paper, than which I have never listened to one more interesting to practical architects, or more creditable to the author.

Mr. J. JENNINGS, Fellow, said,—It would be presumptuous in me to criticise this able paper; but I think it is desirable to look at every point in connection with a subject under discussion. I have not heard on this present occasion that any other covering for walls than Parian cement or lime white has been noticed. Considering the great extent to which tiles and enamelled slates are used for coverings for walls, especially at Liverpool, and the question also whether glass tiles are not capable of being employed in the same way, I should be glad to know whether it has been considered that a covering of such materials, set in cement, would be suitable for the walls of hospital wards. It is clear a surface of glazed tiles or enamelled slates is not liable to either of the evils referred to in respect of any infection, but such a surface would be in a great degree liable to condensation of moisture; at the same time I imagine that the provisions made by Mr. Currey may be sufficient to carry off the air in such a state as to prevent this disadvantage. On the question of ventilation generally, which is a most important one, I do not see in Mr. Currey's arrangements that he has made any especial provision for carrying off the carbonic acid gas, which will have to be carried off, not from the upper, but from the lower parts of the building. Probably he calculates upon it passing out of the doors; but in summer time I conceive its egress would be dependent upon being drawn out by opening the window sashes at the top. I am not aware whether he considers opening the top of the sashes sufficient for the ventilation of the wards in the summer time. It is true that carbonic gas does not always remain at the bottom of a room, but will sometimes pass up to the top from various causes. Fires while burning would draw it off under ordinary circumstances, but I should like to know what provision is made for carrying it off when there are no fires. In practice it is found that when openings are provided near the ceiling, air, instead of going out through them, is likely to come in; and, therefore, while fires are

burning it is difficult to get such methods of drawing out the air to act, and at the same time to supply the fires sufficiently with air. In the case of Sir Charles Barry's dining room, it sometimes happened that the ventilation took the wrong turn and blew out the gas. The same thing has also happened where we have attempted to carry ventilation out by means of pipe or other flues adjoining and *heated* by the smoke flues; the draft now and then turns the wrong way and brings down the air. It is a question whether we should not provide for the admission of air down from the roof by the same sort of plan as Mr. Currey has provided for taking it out. I heard of a case a short time since in which external air at a temperature of thirty degrees was brought down at the side of the flue, and entered the room at fifty degrees, half way between the ceiling and the chimney opening, and thus the warmth of the room was considerably increased.

Mr. C. FOWLER, Fellow.—I cannot refrain from expressing the great interest with which I have listened to this paper, which appears to me to suggest three subjects for congratulation. In the first place, we may congratulate our friend, as I am sure we all do most heartily, on the satisfactory completion of such an important monument, for it deserves that name. In the second place, we may congratulate the profession generally upon the liberality which the Governors of the hospital have displayed in enabling the architect to carry out such a building; and the third party for congratulation is, I think, the public upon having received so important an addition to the monumental objects of the metropolis. The subject of hospital construction I had occasion to consider about twenty years ago. At that time this subject was not so well understood or settled as at the present time. I suppose we may consider, after a great deal of discussion during that period, we have at length arrived at some tolerably definite ideas upon it. But twenty years ago it was, as many present are aware, a very open subject as to what the arrangements of a hospital should be, and the particular building which I have in my mind was the subject of a great deal of discussion; and, eventually, the wrong plan was adopted. The architect in that case was restricted as to the expenditure to the extent that the cost was under £ 100. per bed for everything; and the cost per foot cube was about 5½d., or only a little more than half what it has been in the present instance. We now know pretty well that that scale is much too low to provide an efficient establishment of this kind, and is matter of congratulation that we have made in the period of twenty years satisfactory progress in our knowledge of this subject. It is too late, even if one could do so, to enter upon any criticisms of this work, but I could not help feeling that it was altogether a subject for congratulation that more enlightened views on the subject of hospital construction obtain in the present day to what was the case twenty years ago.

Dr. MASSEY, Visitor.—In obedience to the request of the President I shall make a few observations upon the questions under discussion. I shall not attempt to enter into the numerous architectural merits of this hospital, but beg to make a few remarks upon portions of the ward construction which I trust will not be deemed inapplicable. Like the rest of the building the wards have, in my opinion, many great merits. I think the arrangement for cutting off the lifts from the wards by two doors, and thereby preventing a common atmosphere in the wards of each pavilion, is a great advantage. The floors of the wards being closely jointed oak, if well waxed and rubbed, will be as non-absorbent as the walls; and I quite concur with the speaker who considers non-absorbent walls the best for hospital wards. The water-closets, lavatories, and baths, at the ends of the wards are well situated and well ventilated, and their arrangement such as to prevent any nuisance arising from them to the wards to which they are contiguous. Each ward is intended, as far as I can gather from the description, to be self or independently ventilated; but there are some features regarding their ventilation which I should like to have heard more particularly described. For instance, Mr. Currey did not state the proportion of the area of inlet and outlet air apertures, though no doubt it has been arranged on some definite

relation each to the other, as well as the area of both, either to the size of the wards or to the number of occupants they are intended to accommodate. The general plan of the ward ventilation I should also like to have heard more detailed. It appears to me that it may be considered a summer and a winter system. As the wards are built upon the pavilion plan, which I believe to be the best, by opening the windows in summer good ventilation can always be obtained. The winter ventilation, as I understand it, does not appear to me so good. There are two modes of inlet, one along the floor in connection with hot water coils, and the other passing direct to the stoves, in connection with which the air is warmed before distribution to wards; thus all the air admitted is heated. It appears to me that, unless care is taken, such a system will be apt to render the air too dry for the use of the patients. There are two systems of foul air outlet, one in the side walls at the end of the wards, and the other round the chimneys near the ceiling. Those at the ends of the wards pass into long horizontal flues which communicate with a common flue from which the extraction is made by heat, somewhat analogous to the system known as Jebb's, which has been adopted in many jails, and which I do not consider well suited for hospitals. With regard to the outlets at the ceiling round the chimneys, it appears to me that part of the heat from the fires, and part of the fresh air warmed by the stoves, will pass up direct through them, without being distributed in the wards, and that this may be augmented when the gas is lit, as the gas jets are situated round the chimneys, and will tend to increase the upward outlet current; and if these outlets round the chimneys have communication with those of the different wards in each pavilion, I think it very objectionable.

Mr. CURREY (in reply upon the discussion), said—I will say one or two words in reply to the observations that have been made. In the first place Dr. Balfour referred to the shafts in the centre of the wards. I may say with regard to those that we do not depend principally upon them for ventilation. The fact is, the outer casing was put up with a view to prevent the air being deteriorated by contact with the smoke tube from the stoves. Having that space it seemed a pity not to use it as an extraction shaft. The main ventilation is at the two ends of the wards at the top and bottom, and those shafts are much larger than those provided in the centre, and the rarefying power in the tower will be in operation in summer and winter, and day and night. With respect to the carbonic acid gas referred to by Mr. Jennings, which is no doubt very capricious, we have made arrangements for carrying that off, either at the top or the bottom of the wards. The Parian cement question has, I think, been fully disposed of by Dr. Carter and other speakers. A similar material was used on the walls of the new wards of the old hospital, and those were washed down every summer, and that was found to answer satisfactorily, and in my opinion it is much preferable to the rough surface of lime white. With regard to Mr. Jennings's suggestion as to the use of tiles, I think the number of joints in tile surfaces is objectionable as being harbours for vermin; the use of slate in larger pieces would get rid to a great extent of that objection, but it becomes expensive. I am sorry I am not in a position to give Dr. Massey the information he asked for as to the relative proportions of inlet and outlet; but as far as I can recollect the inlet is about fifty inches to each patient, and the extraction shaft is much larger than that. With regard to the amount of light in the operating theatre, if it is found that the present supply is insufficient, it can very readily be increased, because there are a number of blank windows at the top, which will be available for the purpose.

Dr. BALFOUR.—Is there any arrangement to prevent the foul air of one ward getting into another ward, through the centre tube? as I imagine under certain circumstances that might be the case.

Mr. CURREY.—Looking at the passage where it passes from one floor to another the air must go up a considerable distance and come down again, before what Dr. Balfour alludes to can take place, and the centre shafts are all connected with the main extracting shaft.

THE PRESIDENT.—As the hour is growing late, I will not detain you a minute before asking you to pass a unanimous vote of thanks to Mr. Currey. I would only say, having myself been frequently consulted on the matter, my own opinion goes in favour of the use of Parian cement for the walls of the wards of hospitals. It was done in the case of the Middlesex Hospital, though under the disadvantages of having an old building to deal with. All that is done, is to have the walls thoroughly cleaned down once a year, and to do that the beds are either taken out of the ward, or placed in the centre out of the way of the washing. We have had no difficulty from condensation of the vapour; and I cannot conceive that the comparatively rough surface of lime-white, however treated, can be a good thing. I have had the pleasure of going over this hospital with Mr. Currey, and I was struck with the absence of all unnecessary ornamentation involving a large expenditure, and this in such a building, appears to me a most judicious point in Mr. Currey's treatment of it. You will, I am sure, all join me in a most cordial vote of thanks to Mr. Currey, for his most interesting communication.

The vote of thanks to Mr. Currey having been put by the President, it was carried by acclamation, and Mr. Currey expressed his acknowledgments for the high compliments that had been paid him.

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